Cu-BASED SINTERED ALLOY AND METHOD FOR PRODUCING THE SAME AND BEARING USED FOR MOTOR FOR PURE WATER

INCORPORATION BY REFERENCE

The present application claims priority under 35 U.S.C. §119 to Japanese Patent Application No. 2003-65717 filed on March 11, 2003. The content of the application is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a Cu-based sintered alloy and a method for producing the same and a motor used for a motor for pure water.

2. Description of the Related Art

An anti-corrosion measure adapted to working conditions is important for securing durability in this kind of sintered alloy. For example, in a fuel cell power generator in which raw fuel of hydrocarbon system, such as natural gas, LPG gas, naphtha, or alcohol system such as methanol is reformed into a hydrogen-enriched reformed gas with a fuel reformer, the reformed gas is supplied to a fuel cell, and the supplied reformed gas causes a fuel reaction with separately supplied air to generate electricity, a water treatment device includes an ion-exchange type water treatment unit to turn the recovered water from a recovered water tank into pure water (Japanese Unexamined Patent Application Publication No. 6-231787 (Sections Nos. 0002 and 0006)). In this case, a pump for

pumping out the pure water has a problem of easy corrosion due to the pure water.

A pump unit of the structure illustrated in the sectional view of Fig. 9 is disclosed in Japanese Unexamined Patent Application Publication No. 2001-192754. In other words, a pump unit 1 inside a casing 2 includes: a rotating shaft 4 fixed to both ends of a motor 3 to be supported with a bearing 5; an impeller 6 inserted into one end of the rotating shaft 4; and a narrow flow passage (not shown) formed at the impeller 6, at the outer peripheral surfaces of the motor 3 (armature) and along a gap between the bearing 5 and the rotating shaft 4. The impeller 6 is rotated by rotation of the motor 3 to get fluid taken into the casing 2. Then, the fluid is delivered through a gasoline flow passage formed at the impeller 3, at the outer peripheral surface of the motor 3 and along a gap (not shown) between the bearing 5 and the rotating shaft 4. In addition, a very small amount of liquid passes through the outer peripheral portions of two bearings 5 in Fig. 9, the pressure of liquid is raised by the impeller 6, the liquid passes through the fluid passage of the casing 2 to reach the outer peripheral portion of the motor 3.

A copper-based sintered alloy is used for the bearing 5 that is a structural member of the pump unit 1. In the method of producing the Cu-based sintered alloy, a raw material powder containing copper is compressed and formed into a green compact, which is then sintered and formed into a sintered alloy. Sizing as repressing is performed on the sintered alloy so that it is finished into a predetermined dimension.

Further, when the pump unit 1 is used for forced delivery of pure water, the sintered alloy of the pump unit 1 which contacts water, such as pure water, a portion of which is ionized and divided into hydrogen ion and hydroxide ion, melts and easily corrodes. Therefore, the bearing 5 of the pump unit 1 wears out along with its corrosion, which results in damage of durability.

A copped-based sintered alloy is used for bearings 5 that are a structural member of the pump unit 1. According to the method of producing the sintered alloy, a raw material powder containing copper is compressed and formed into a green compact, which is then sintered and formed into a sintered alloy. Sizing as repressing is performed on the sintered alloy so that it is finished into a predetermined dimension.

Thus, when the pump unit 1 is used for forced delivery of pure water, the sintered alloy of the pump unit 1 in contact with pure water, a portion of which is ionized into hydrogen ion and hydroxide ion, melts and easily corrodes. Therefore, the bearing 5 of the pump unit 1 wears out along with easy corrosion, which results in damage of durability.

SUMMARY OF THE INVENTION

The present invention has been made in order to solve the aforementioned problems. It is therefore an object of the present invention to provide a Cu-based sintered alloy and a method for producing the same, and a bearing used for a motor for pure water, which has excellent corrosion resistance in an environment exposed to water.

In order to accomplish the aforementioned object, a Cu-based sintered alloy according to a first implementation of the invention contains, by mass percent, Ni: about 5 to about 25%, P: about 0.1 to about 0.9%, and C: about 1 to about 7%, with a fluororesin layer provided in its external surface.

According to the structure of the first implementation, the Cu-based sintered alloy is covered with a fluororesin layer having corrosion resistance, resulting in high corrosion resistance against ionized water and improvement in durability of the Cu-based sintered alloy with excellent resistance against abrasion under the condition contacting pure water.

A second implementation of the invention is the Cu-based sintered alloy of the first implementation, where the fluororesin is tetrafluoroethylene resin, tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer or tetrafluoroethylene-hexafluoropropylene copolymer.

According to the structure of the second implementation, the aforementioned fluororesin has particularly high thermal stability and an extremely low coefficient of friction.

A third implementation of the invention is the Cu-based sintered alloy of the first implementation, where the thickness of the fluororesin layer is about 1 to about 40 μm.

According to the structure of third implementation, if the thickness of the fluororesin layer is less than 1 μm, the corrosion resistance against organic acid decreases. On the other hand, if the thickness of the fluororesin layer exceeds 40 μm, it becomes difficult to maintain the dimensional

precision. As a result, the thickness of the fluororesin layer is restricted to about 1 to about 40 μm.

A fourth implementation of the invention is a bearing used for a motor for pure water, wherein the bearing is made of the Cu-based sintered alloy of the first implementation.

According to the structure of the fourth implementation, the bearing has a prolonged life span even under the working conditions contacting sulfur, its compounds or pure water.

A method for producing the Cu-based sintered alloy according to a fifth implementation of the invention contains, by mass percent, Ni: about 5 to about 25%, P: about 0.1 to about 0.9%, and C: about 1 to about 7%, wherein fluororesin is impregnated in the Cu-based sintered alloy.

According to the structure of the fifth implementation, the fluororesin has a low dispersity in water or solvent with difficulty in entering the pores by coating. However, an impregnation process can be used to put the fluororesin into the pores. Since fluororesin is applied not only to the external surface but into the pores as well, there may be only a little increase in the coefficient of friction in spite of abrasion of the Cu-based sintered alloy. Therefore, it is possible to achieve a stable sliding performance of the bearing for a long period of time.

A sixth implementation of the invention is the method for producing the Cu-based sintered alloy according to the fifth implementation, wherein the open porosity of the Cu-based sintered alloy is about 2 to about 30% before impregnation of the fluororesin.

According to the structure of the sixth implementation, the pores dispersed in a green body of the sintered alloy play a role to relieve friction and surface pressure that may be applied under the high-pressure and high-speed circulation pure water and to restrict abrasion of the bearing. When its open porosity is less than 2%, the ratio of pores dispersed in the sliding surface gets so low that the abrasion suppressing function cannot be accomplished. On the other hand, if the open porosity exceeds 30%, the strength of the sintered alloy decreases. Therefore, it is preferable that the open porosity is set to about 2 to about 30%.

A seventh implementation of the invention is the producing method according to the fifth or the sixth implementations, wherein the fluororesin is tetrafluoroethylene resin, tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer or tetrafluoroethylene-hexafluoropropylene copolymer.

According to the structure of the seventh implementation, the aforementioned fluororesin has particularly high thermal stability and an extremely low coefficient of friction.

An eighth implementation of the invention is a bearing used for a motor for pure water, wherein the bearing is made of the Cu-based sintered alloy produced according to the method according to the fifth implementation.

According to the structure of the eighth implementation, the Cu-based sintered alloy is covered with a fluororesin layer having corrosion resistance, resulting in high corrosion resistance against ionized water and improvement in

durability of the Cu-based sintered alloy with high resistance against abrasion under the condition contacting pure water.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a flowchart illustrating a method for producing a sintered alloy according to a first embodiment of the invention;

Fig. 2 is a perspective view of a sintered alloy according to the first embodiment of the invention;

Fig. 3 is a partially enlarged, sectional view of the sintered alloy according to the first embodiment of the invention;

Fig. 4 is a schematic explanatory view of a fuel cell system using a pump unit according to the first embodiment of the invention;

Fig. 5 is a flowchart illustrating a method for producing a sintered alloy according to a second embodiment of the invention;

Fig. 6 is an enlarged, sectional view of an external surface of a sintered alloy of Experiment 1 according to the second embodiment of the invention;

Fig. 7 is an enlarged, sectional view of an external surface of a sintered alloy of Experiment 2 according to the second embodiment of the invention;

Fig. 8 is a graph illustrating quantity of abrasion and time according to the second embodiment of the invention; and

Fig. 9 is a schematic sectional view of a pump.

BRIEF DESCRIPTION OF THE DRAWINGS

Hereinafter, preferred embodiments of the invention will be described with reference to the accompanying drawings. Figs. 1 to 4 illustrate a first embodiment of the invention. Besides, the bearing 5 will be described below as an example of a sintered alloy.

As illustrated in Figs. 2 and 3, the bearing 5 is made of a substantially cylindrical sintered alloy 51. A cylindrical sliding surface 52 is formed in the center of the bearing 5 to allow the sliding rotation of the rotating shaft 4. Besides, a fluororesin layer 53 is formed to cover all over the exposed, external surface of the sintered alloy 51. Preferable examples of the fluororesin may include tetrafluoroethylene resin (PTFE (Teflon (registered trademark)), tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer (PFE (Teflon (registered trademark)) or tetrafluoroethylene-hexafluoropropylene copolymer (FEP (Teflon (registered trademark)).

The sintered alloy 51 of the bearing 5 may include a graphite-dispersed Cu-based sintered alloy which contains, approximately by mass percent, Ni: 5 to 25%, P: 0.1 to 0.9%, and C: 1 to 7%, the balance being Cu and inevitable impurities, and which has an open porosity of about 2 to about 30%. The sintered alloy 51 may include another graphite-dispersed Cu-based sintered alloy which contains, approximately by mass percent, Ni: 5 to 25%, P: 0.1 to 0.9%, C: 1 to 7%, and Zn: 5 to 25%, the balance being Cu and inevitable impurities, and which has an open porosity of 2 to 30%. Besides, the pores

play a role to relieve friction and surface pressure that may be applied under the high-pressure and high-speed circulation pure water and to suppress abrasion of the bearing 5. When its open porosity is less than 2%, the ratio of the pores dispersed in the sliding surface gets so low that the abrasion suppressing function cannot be exhibited. On the other hand, if the open porosity exceeds 30%, the strength of the sintered alloy 51 decreases. Therefore, the open porosity is set to about 2 to about 30% and preferably to 5 to 25%.

The method for producing the sintered alloy will now be described with reference to Fig. 1. A raw material powder to be used for the sintered alloy 51 is formed using a water atomization method. A preparation is made for a Cu-Ni alloy powder having an average particle diameter of 45 μm, a water-atomized Cu-P alloy powder (containing P of 33%) having an average particle diameter of 45 μm, and a graphite powder having an average particle diameter of 75 μm. The above raw material powders are combined according to a predetermined blending composition and mixed in a V-shaped mixer for 40 minutes (S1: step 1). Then, the mixed raw material powders are formed into a predetermined shape of a green compact by a press within a predetermined pressure range of 150 to 330 MPa (S2). In the ammonia decomposition gas atmosphere, the green compact is sintered within a predetermined temperature range of 750 to 900°C for 40 minutes (S3). Those steps results in production of a bearing 5 made of a graphite-dispersed Cu-based sintered alloy. If the bearing 5 obtained by the steps is observed with optical microscope (200 times), Cu-P

alloy and graphite are finely and dispersedly distributed in a green compact of solid solution phase of a Cu-Ni alloy with pores in its texture. The bearing 5 of the graphite-dispersed Cu-based sintered alloy obtained in the aforementioned steps shows excellent abrasion resistance, together with excellent strength and corrosion resistance which are possessed by Cu-Ni alloy forming the green body.

After the sintering step S3, the sintered alloy 51 is sized (or repressed) and finished into a predetermined dimension. Besides, in the present invention, in order to improve the corrosion resistance against a high purity of pure water, a portion of which is ionized, a surface coating treatment (S5) is performed to form a fluororesin layer 53 on the sintered alloy 51. The surface coating treatment (S5) can be performed by a method, such as spray coating, tumbling coating or dip coating.

A plurality of bearings 5 to which the surface coating step (S5) is performed is formed as described above. The bearings 5 have a fluororesin layer 53 whose thickness is 15 μm. A test is performed by designating the fluororesin layer as 'with a resin layer'. PTFE (Teflon (registered trademark)) is selected for the fluororesin layer 53. For the purpose of comparison, another test is performed on the bearing 5 as 'with no resin layer' in which resin is not provided.

In order to make a comparison about corrosion resistance, a test was performed on the corrosion resistance against water by putting bearings 5 'with a resin layer' and 'with no resin layer' respectively into vessels full of pure water and

visually observing a change in the bearings 5 after 60 days. While no change was seen in the bearing 'with a resin layer', development of patina was seen in the bearing 'with no resin layer'. Furthermore, there was no change in the bearing 'with a resin layer' even after 180 days.

It is confirmed that a progress is made in the corrosion resistance in the atmosphere of ionized water in case of the bearing 5 of the invention provided with a fluororesin layer 53 that was made of tetrafluoroethylene resin at the external surface of the Cu-based sintered alloy of the bearing 5 as described above. When the bearing with a fluororesin layer 53 of 0.5 μm was tested, it was not sufficiently confirmed that there was an improvement in the corrosion resistance. However, it was found that when the coating process is performed on the bearing 5, the required lower limit of thickness of the fluororesin layer 53 is greater than 1 μm. If the dimensional precision of the bearing 5 as a product is seriously taken into account, it is preferable that the thickness of the fluororesin layer 53 is limited to less than 40 μm. Particularly, in this kind of bearing 5 as described above, its dimensional precision is required to be less than several tens of micrometers. Therefore, it is preferable that the upper limit of the thickness of the fluororesin layer 53 is set to about 40 μm. Further, as a result of a test with other levels of thickness, it was found that it is more preferable that the thickness of the fluororesin layer 53 is set to 15 to 40 μm.

When PFE or FEP was used for making the fluororesin layer

53, it was confirmed that the fluororesin layer 53 has the same corrosion resistance as that of PTFE (Teflon (registered trademark)).

Next, an example of a fuel cell system using the motor 3 as described above will be described with reference to Fig. 4. A fuel cell 61 includes an air electrode (cathode) 62 and a fuel electrode (anode) 63. Oxygen is supplied to the air electrode 61 by an air supplying means 64 while hydrogen is supplied from the fuel reformer 65 to the fuel electrode 63. There are chemical reactions respectively in the air electrode 62: $O_2+4H^++4e^-\rightarrow 2H_2O$ and in the fuel electrode 63: $2H_2\rightarrow 4H^++4e^-$. The chemical reactions generate water consisting of hydrogen and oxygen and electricity.

Water generated in the air electrode 62 is collected as pure water W to a recovery tank 67 by an ion-exchange type of water treatment device 66 that is a water purifying device having an ion exchange membrane, and the remainder is disposed. In the aforementioned example, methanol is used as raw fuel. The methanol is sent from a fuel tank 68 through a fuel pump 69 to the fuel reformer 65. The pure water W collected in the recovery tank 67 is sent through the pump unit 1 to the fuel reformer 65. In the fuel reformer 65, a steam reforming process is performed as follows: $CH_3OH+H_2O\rightarrow CO_2+3H_2$. Then, the reaction generates hydrogen gas, which is then supplied to the fuel electrode 63.

Besides, the fuel electrode 63 has a circulating path 73 provided with a circulating pump 71 and a condenser 72, so that the pure water W generated in the condenser 72 is returned

to the recovery tank 67. In addition, pure water W, a portion of which has been ionized, flows in the circulating pump 71 as well. Therefore, the pump unit 1 for the circulating pump 71 may be used.

In the aforementioned fuel cell system, a pump unit 1 is provided for forcible delivery of pure water W, a portion of which is ionized by the ion exchange membrane. Since the bearing 5 is in contact with pure water W, the structure of the invention can be employed to secure corrosion resistance and abrasion resistance. As a result, the bearing 5 may have high corrosion resistance against other types of pure water generated in water purifying or filtering devices as well as the pure water as described above.

As described above, the present embodiment provides a Cu-based sintered alloy 51 in which the sintered alloy contains, approximately by mass percent, Ni: 5 to 25%, P: 0.1 to 0.9%, and C: 1 to 7%, with a fluororesin layer 53 provided in its external surface thereof. The Cu-based sintered alloy 51 is covered with the fluororesin layer 53, which result in high corrosion resistance against ionized water and improve durability of the Cu-based sintered alloy 51 having excellent abrasion resistance under the conditions contacting pure water. Furthermore, the bearing 5 has not only the high level of durability under the conditions where the Cu-based sintered alloy 51 is in contact with pure water, but it can also be made into a cheap product because of relatively simple composition.

As described above, the present embodiment also provides

the Cu-based sintered alloy in which the fluororesin is tetrafluoroethylene resin, tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer or tetrafluoroethylene-hexafluoropropylene copolymer. Thus, the resultant bearing has particularly high thermal stability with an extremely low coefficient of friction.

As described above, the present embodiment also provides the Cu-based sintered alloy in which the thickness of the fluororesin layer 53 is approximately 1 to 40 μm. Thus, it is possible to obtain a bearing 5 of a sintered alloy having high corrosion resistance both against sulfur or its compounds and against organic acids, such as formic acid and acetic acid. In case of the coating process, it is preferable that the thickness of the fluororesin layer 53 is limited to the range of approximately 1 to 40 μm. If the thickness of the tetrafluoroethylene resin layer 53 is less than 1 μm, the corrosion resistance deteriorates. On the other hand, if the thickness of the layer 53 exceeds 40 μm, it is difficult to maintain the dimensional precision of the product.

As described above, the present embodiment also provides a bearing 5 used for a motor 3 for pure water in which the bearing 5 is made of the Cu-based sintered alloy. Thus, the bearing 5 may have prolonged life span under the working conditions contacting sulfur or its compounds or pure water.

Figs. 5 to 8 illustrate a second embodiment of the invention. Same reference numerals are given the same parts as those in the first embodiment, and the detailed description of which will be omitted. In the second embodiment of the

invention, the sintered alloy 51 is sized or repressed (S4) and then finished into its predetermined dimension. Further, in the second invention, in order to improve corrosion resistance against pure water, a portion thereof is ionized, fluororesin is impregnated (S6) in the sintered alloy 51 after the sintering step (S3). The vacuum impregnation step (S6) is performed as follows: the sintered alloy 51 is put into a vacuum chamber (not shown); the pressure of the chamber is depressurized with a vacuum pump to a predetermined level of pressure which is maintained for a certain period of time; at this time, the sintered alloy 51 placed in vacuum in the vacuum chamber is put into penetrant of fluororesin; the penetrant of fluororesin is put into pores 81 and simultaneously attached to the external surface 80 of the sintered alloy 51 when the vacuum chamber is opened in air; and a drying treatment is carried out if necessary.

When the vacuum impregnation process (S6) as described above is performed, as illustrated in Fig. 6, fluororesin is attached to the external surface 80 of the sintered alloy 51 to form a fluororesin layer 53 with a thickness of about 0.1 to 20 μm. In addition, fluororesin is attached to the internal surface of the pores 81 to form a fluororesin layer 53 with a depth of about 0.1 to 0.2 μm from the external surface. Moreover, fluororesin particles are difficult for dispersion in the penetrant. The secondary particles 82 that are fluororesin lumps are attached to stepped portions 83 of the pores 81. At this time, the size of the secondary particles 82 is approximately 0.2 to 0.5 μm. It was confirmed that the

secondary particles 82 are partially attached to the internal surface of the pores 81 other than the stepped portions 82.

Experiments

In Experiments 1 and 2, the sintered alloy 51 contains, approximately by mass percent, Ni: 5 to 25%, P: 0.1 to 0.9%, and C: 1 to 7%, the balance being Cu and impurities, and which has an open porosity of 15%. A bearing with an external diameter of 9 mm x an internal diameter of 5 mm x a height of 6 mm is used, and PTFE (Teflon (registered trademark)) is used as fluororesin. Experiment 1 uses a bearing 5 having a fluororesin layer 53 with an average thickness of 10 μm at the external surface 80 of the sintered alloy 51 produced by the method of the first embodiment as shown in Fig. 7. Experiment 2 uses a bearing 5 with an average thickness of 5 μm at the external surface 80 of the sintered alloy 51 produced by the method of the second embodiment as shown in Fig. 6. In addition, the rotating shaft 4 is used in the bearing 5 to carry out the experiments.

Fig. 8 is a graph illustrating results of tests performed under the same conditions like number of rotation and loads for the bearing 5 of Experiments 1 and 2. The graph illustrates the quantity of abrasion of the sliding surface 52 of the bearing at its vertical axis and the elapsing time H at its horizontal axis, and the test result of Experiment 1 with a solid line and that of Experiment 2 with a broken line. As shown in the drawing, in Experiment 1, the quantity of abrasion is great for the first five minutes, that is the time taken for the fluororesin layer 53 of the external surface 80 and

the rotational axis 4 to be adjusted, but it turns out to be stable later on. On the other hand, in Experiment 2, the abrasion amount is almost constant from the beginning of the test to thereby lead to a stable characteristic of the bearing 5. In Experiment 1, a portion P of fluctuating changes in the quantity of abrasion is seen in the middle of the graph, and the portion P is caused by the peeling of the fluororesin layer 53 blocking the external side of the pores 81 after 1000 hours have elapsed.

Therefore, when the pores 81 are formed at the external surface 80 of the sintered alloy 51, the fluororesin is formed in the pores 81 by impregnation for the stable sliding characteristic.

As described above, the present embodiment provides a method of producing a Cu-based sintered alloy in which the Cu-based sintered alloy 51 contains, approximately by mass percent, Ni: 5 to 25%, P: 0.1 to 0.9%, and C: 1 to 7%, with the fluororesin being provided at the external surface 80 and in the pores 81. The fluororesin is not applied to the pores 81 by a method such as a coating process because it is difficult for dispersion in water or solvent. However, the impregnation process is performed to make fluororesin enter the pores 81. Since fluororesin is applied to the pores 81 as well as at the external surface 80, there is a little increase in the coefficient of friction and slow abrasion despite abrasion of the Cu-based sintered alloy 51. As a result, it is possible to achieve a stable sliding capability of the bearing for a long period of time.

As described above, the present embodiment also provides a method of producing the Cu-based sintered alloy in which the open porosity of the Cu-based sintered alloy 51 before impregnation of fluororesin is about 2 to about 30%. Thus, the pores 81 dispersed in the green body of the sintered alloy 51 play a role to relieve friction and surface pressure which may be applied under the conditions like high pressure and speed of pure water and to suppress abrasion of the bearing 5. When its open porosity is less than 2%, the ratio of the pores 81 dispersed in the sliding surface 52 gets so low that the abrasion suppressing function cannot be accomplished. On the other hand, if the open porosity exceeds 30%, the strength of the sintered alloy 51 decreases. Therefore, it is preferable that the open porosity is set to about 2 to about 30%.

As described above, the present embodiment also provides the method for producing the Cu-based sintered alloy in which the fluororesin is tetrafluoroethylene resin, tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer or tetrafluoroethylene-hexafluoropropylene copolymer. Thus, the resultant bearing has particularly high thermal stability with an extremely low coefficient of friction.

As described above, the present embodiment also provides a bearing 5 used for a motor for pure water in which the bearing 5 is made of the Cu-based sintered alloy. Thus, the Cu-based sintered alloy 51 is covered with a fluororesin layer 53 having corrosion resistance, resulting in high corrosion resistance against ionized water and improvement in durability of the

Cu-based sintered alloy with high resistance against abrasion under the conditions contacting pure water.

In addition, the invention is not limited to the preferred embodiments as described above, but a variety of changes may be made. For instance, the present invention may be applied to various shapes of bearings without limitation to the embodiment as described above.

In order to accomplish the aforementioned object of the invention, a Cu-based sintered alloy is provided in which a fluororesin layer is provided at the external surface of the sintered alloy.

A bearing made of the Cu-based sintered alloy is covered with the fluororesin layer having corrosion resistance so that a high level of corrosion resistance against pure water can be obtained.

Further, the Cu-based sintered alloy is provided in which the fluororesin is tetrafluoroethylene resin, tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer or tetrafluoroethylene-hexafluoropropylene copolymer. Thus, the resultant bearing has particularly high thermal stability with an extremely low coefficient of friction.

Further, an embodidment of the invention provides a Cu-based sintered alloy in which the thickness of the tetrafluoroethylene resin layer is about 1 to about 40 μm. Thus, high corrosion resistance against pure water can be obtained.

Further, another embodiment of the invention is a bearing used for a motor for pure water in which the bearing is made

of the Cu-based sintered alloy. Thus, the bearing has high corrosion resistance against pure water.

In a method for producing the Cu-based sintered alloy, the open porosity of the Cu-based sintered alloy before impregnation of fluororesin is about 2 to about 30%. Thus, a stable sliding performance for a long period of time can be obtained.

Further, another embodiment of the invention provides a method for producing the Cu-based sintered alloy in which the open porosity of the Cu-based sintered alloy is about 2 to about 30%. Thus, a stable sliding performance for a long period of time can be obtained.

Further, still another embodiment of the invention provides a producing method in which the fluororesin is tetrafluoroethylene resin, tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer or tetrafluoroethylene-hexafluoropropylene copolymer. Thus, particularly high thermal stability with an extremely low coefficient of friction can be obtained.

According to the structure of the embodiment, the fluororesin results in particularly high thermal stability with an extremely low coefficient of friction.

Further, an embodiment of the invention provides a bearing used for a motor for pure water in which the bearing is made of the Cu-based sintered alloy. Thus, the bearing has high corrosion resistance against pure water or the like.